

Claims:

1. A method of detecting double-talk and path changes in an echo cancellation system, comprising:
  - generating a correlation-based matrix of signals in said echo cancellation system;
  - 5 and
  - analyzing said correlation-based matrix to identify double-talk and path changes occurring in said system.
2. A method as claimed in claim 1, wherein said correlation-based matrix is generated using zero-lag auto and cross-correlations of said signals.
- 10 3. A method as claimed in claim 2, wherein a determinant of said matrix is used to detect said double-talk and path changes.
4. A method as claimed in claim 3, wherein said double-talk and path changes are inferred when the value of said determinant passes predetermined threshold values.
5. A method as claimed in claim 2, wherein eigendecompositions of said matrix are
- 15 used to detect said double-talk and path changes.
6. A method as claimed in claim 2, wherein single valued decompositions of said matrix are used to detect said double-talk and path changes.
7. A method as claimed in claim 2, wherein condition numbers of said matrix are used to detect said double-talk and path changes.
- 20 8. A method as claimed in claim 1, wherein said echo cancellation system includes an adaptive filter, and said signals comprise an echo signal and an output of said adaptive filter.
9. A method as claimed in claim 8, wherein said filter is an LMS filter.
10. A method as claimed in claim 9, wherein said LMS filter implements a
- 25 normalized-LMS algorithm.
11. A method as claimed in claim 1, wherein the elements of said correlation-based matrix are generated in the time domain.

12. A method as claimed in claim 1, wherein the elements of said correlation-based matrix are generated in the frequency domain.

13. A method as claimed in claim 3, wherein said determinant  $\mathbf{R}$  is of the form

$$\mathbf{R} = E \begin{bmatrix} X_0 X_0^T & X_0 X_1^T \\ X_1 X_0^T & X_1 X_1^T \end{bmatrix}$$

5 wherein  $X_0[n]$  and  $X_1[n]$  are generated by a linear combination of two real-valued source signals,  $S_0[n]$  and  $S_1[n]$ .

14. A method as claimed in claim 1, wherein  $S_0[n]$  comprises an echo signal and  $S_1[n]$  comprises a cancellation signal.

10 15. A double-talk and path change detector, comprising:  
a processing element generating a correlation-based matrix of signals in said echo cancellation system; and  
a processing element for analyzing said correlation-based matrix to identify double-talk and path changes occurring in said system.

15 16. A double-talk and path change detector as claimed in claim 15, wherein said correlation-based matrix is generated using zero-lag auto and cross-correlations of said signals.

17. A double-talk and path change detector as claimed in claim 16, wherein a determinant of said matrix is used to detect said double-talk and path changes.

20 18. A double-talk and path change detector as claimed in claim 16, wherein said double-talk and path changes are inferred when the value of said determinant passes predetermined threshold values.

19. A double-talk and path change detector as claimed in claim 16, wherein eigendecompositions of said matrix are used to detect said double-talk and path changes.

25 20. A double-talk and path change detector as claimed in claim 16, further comprising an adaptive filter, and said signals comprise an echo signal and an output of said adaptive filter.

21. A double-talk and path change detector as claimed in claim 20, wherein said filter is an LMS filter.

22. A double-talk and path change detector as claimed in claim 17, wherein said determinant (**R**) is of the form

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$$\mathbf{R} = E \begin{bmatrix} X_0 X_0^T & X_0 X_1^T \\ X_1 X_0^T & X_1 X_1^T \end{bmatrix}$$

wherein  $X_0[n]$  and  $X_1[n]$  are generated by a linear combination of two real-valued source signals,  $S_0[n]$  and  $S_1[n]$ .